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TELEVISION & TELECOMMUNICATION

OSCILLOSCOPE

PM3250X

9499 440 10211

720210/1/X04

ERRATUM

Manual PM 3250X

1. A diode (BAX13) is connected in series with the wire between R2121 and SK32 (anode of this diode connected to R2121).
2. GR2104 is reversed (anode connected to the base of TS2109).
3. The +24 V supply wire is disconnected from the +24 V point of the trigger pick-off stage. A diode (BAX13) is connected with the cathode to the +24 V point of the trigger pick-off stage and the anode connected to point 24 of SK10.
4. C2107 (old 4.7 μF) is 47 nF 10 % 250 V.
5. C2108 (old 2.2 μF) is 100 nF 10 % 250 V.
6. C2117 (old 3.9 nF) is 22 nF −20 +100 % 40 V.
7. R2134 (old 10 MΩ) is 1 MΩ 10 % CR16.
8. R2137 (old 1.5 kΩ) is 4.3 kΩ 5 % CR16.
9. R2138 (old 4.3 kΩ) is 1.5 kΩ 5 % CR16.
10. R2172 (old 1 kΩ) is 3.3 kΩ 5 % CR16.

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I. Introduction

GENERAL INFORMATION

This Appendix describes those special features incorporated in the PM 3250X which is the television and telecommunication applications version of the basic PM 3250 general purpose 50 MHz oscilloscope.

Unlike all other versions, the PM 3250X is equipped with sync. separator, x10 magnifier and mains triggering circuits. The PM 3250X is also equipped with an additional horizontal preamplifier (instead of the former EXT via Y_B amplifier) and gating stage which enables external signals (connected to the oscilloscope via the main time-base TRIGG./EXT. X socket) to be used to drive the horizontal output amplifier.

Both LEVEL x5 trigger selectors of the basic PM 3250, are deleted in favor of the TV frame and line sync. switches.

II. Technical data

A. SYNC. SEPARATOR

Triggering	Triggering is possible on all TV signals greater than 0.5 div. but less than 16 div. amplitude

B. MAINS TRIGGERING

Signal source	Mains frequency derived from a winding of the supply transformer

C. EXTERNAL HORIZONTAL INPUT

Horizontal bandwidth	5 Hz to > 500 kHz
Input impedance	1 MΩ//20 pF
Phase	A positive-going input voltage causes the spot to move from left to right across the screen.
Input connector	The TRIGG./EXT. X connector, provided that the MAIN TB/DEL'D TB/EXTERN switch is set to its EXTERN position.
Input sensitivity	1 V/div. (or 0.1 V/div. when the X MAGN. switch is set to x10)
Adjustable attenuation	A preset potentiometer, accessible through a hole in the right hand side cover of the oscilloscope, providing an adjustable attenuation of approximately x5. Fully clockwise is the calibrated position (x1).

D. X MAGNIFICATION

Magnification	x10. (the X magnification is x5 in the basic version of the oscilloscope).
Sweep linearity at x10 magnification	As stated in the basic PM 3250 technical data, up to 10 ns/div.

III. Accessories

The PM 3250X is supplied complete with the following accessories:

- Manual PM 3250 with Appendix for the X version
- Two BNC/4 mm adaptors (PM 9051)
- Trimming rod
- Collapsible viewing hood (PM 9366)
- Contrast plate, green
- Contrast plate, grey

IV. Operating instructions

DIRECTIONS FOR USE

A. USE OF THE SYNC. SEPARATOR

TV frame triggering

- Connect the composite video signal to a Y input.
- Set the relevant AMPL. switch to a position which provides a convenient display amplitude (0.5 div. will be sufficient for stable triggering).
- Set the main time-base Y_A/Y_B/EXT trigger switch to its relevant position.
- Operate the PULL FOR TV FRAME switch.
- Set the main time-base +/– switch to its + position (independent of the polarity of the video signal).
- For negative-modulated video signals depress the PUSH FOR – VIDEO switch.
  A frame sync. triggered display is now obtained.

TV line triggering

If triggering on a certain TV line is required, proceed as follows:

- Obtain stable triggering on the complete frame as detailed in the above procedure.
- Using the delayed time-base TIME/div. and the Delay time Multiplier controls, intensify the particular line(s).
- Operate the PULL FOR TV LINE switch.
- Set the STARTS/TRIGG. switch to the TRIGG. position.
- Set the delayed time-base +/– switch to + position.
- Transfer the X DEFL. switch to its DEL'D TB position in order to present a full-screen display of the intensified portion.
  The X MAGN. switch (x10) may be used for more detailed study of line information.
  Note that when the delayed time-base is used to display a single TV line as described above, the ambient light conditions may make it advisable to use the collapsible viewing hood PM 9366.
- If main time-base triggering on a unselected TV line is required, normal triggering should be used instead of the built-in sync. separator.
  The LF/HF/DC must be in the DC position. Use the +/– switch and the LEVEL control.

B. MAINS TRIGGERING

- Operate the PUSH FOR MAINS switch in order to inject a mains frequency signal into the main time-base. Note that selection of the mains triggering facility automatically disables the other main time-base triggering sources (also the sync. separator is switched off).
  The +/– switches are normally in use.

C. EXTERNAL HORIZONTAL DEFLECTION

- Connect the external deflection signal source to the TRIGG./EXT. socket of the main time-base.
  Set the X DEFL. switch to its EXTERN position.
  Set the ALT./CHOPP. switch to its CHOPP. position.
  The X MAGN. switch and the preset potentiometer (R20) on the right-hand side of the cabinet, are used in order to set the deflection factor for the external horizontal input signal. With the X MAGN. switch set to its x1 position, the range of the external horizontal preset potentiometer is 1 V/div. to 5 V/div. (0.1 V/div. to 0.5 V/div. if the X MAGN. switch is set to x10). The preset potentiometer must be set to its fully-clockwise position if calibrated operation of the X MAGN. switch is required.
- The display can be shifted with the X POSITION control.

Important

1. If the sync. separator is used, always put the +/– trigger switches in the + position.
2. If both Y channels have to be used, together with an external horizontal input signal, the ALT./CHOPP. switch must be in the CHOPP. position.

V. Circuit description

A. INTRODUCTION

This section of the Appendix describes the sync. separator, mains triggering and external horizontal input circuits which are exclusive to the X version of the PM 3250 oscilloscope. The section also details those modifications which have been made to the basic PM 3250 circuits in order to make them suitable for the PM 3250X.

B. SYNC. SEPARATOR

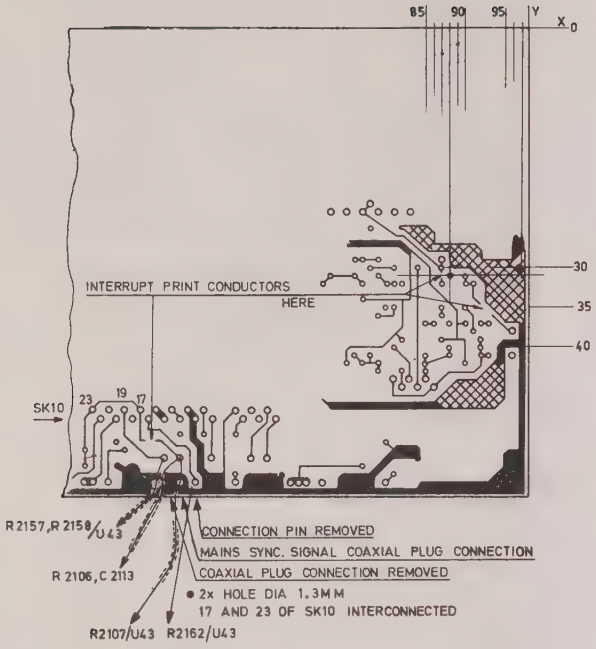
Input signals, taken from the contacts of the Y_A/Y_B/EXT. switch (SK2) are passed to the gate of field effect transistor TS2103. The source and drain voltages of this field effect transistor are in antiphase and it is therefore used to provide phase reversal. The appropriate switching is performed by means of diodes GR2101 and GR2102: these are opened and closed by a −24 V potential which is controlled by the PUSH FOR – VIDEO switch (SK32).
The selected phase is passed to the emitter follower TS2104 via C2106. The signal is then passed through a further four stages of amplification (TS2106, TS2107, TS2108 and TS2109) in which the unwanted 'white' portion of the signal is clipped by diodes GR2103 and GR2104.

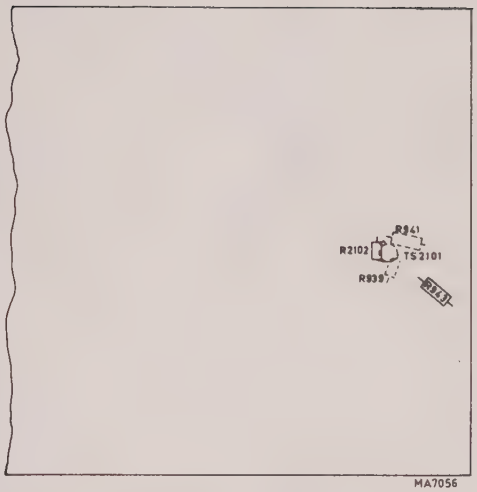
Video frame sync. pulses are formed by passing the signal present at the emitter of TS2109 to the integrator circuit formed by R2139, R2142, C2116, C2117, C2118, C2119 and diode GR2108. Note that the operation of the integrator circuit relies upon the reverse resistance of the OA95 diode (GR2108). The output of the integrator is passed to the emitter follower TS2111.

Operation of the PULL FOR TV FRAME switch (SK5) results in a −24 V potential being applied to field effect transistor TS2101 in order to isolate triggering inputs which are normally passed via the contacts of the LF/HF/DC switch (SK3).
At the same time, a −24 V potential opens switching diode GR2107, so that positive-going frame sync. pulses from the emitter of TS2111 are coupled to TS908 of the main time-base. LEVEL pot. meter R1 is now out of service, because a d.c. level is generated with the aid of C2114, GR2106, R2108 and R2112.
When the oscilloscope is operating in the mains triggering mode (see para V.C) switch SK5 is overriden and TS2101 is cut off. It is therefore impossible to cross-couple frame sync. pulses with mains triggering signals.

Line sync. signals are obtained by means of an output taken from the junction of R2137 and R2138 and fed to the base of emitter follower TS2117.
The emitter output of TS2117 is fed to TS708 of the delayed time-base via diode switching circuit (GR2113).

When the PULL FOR TV LINE switch (SK19) is operated, a −24 V supply is connected to the gate of field effect transistor TS2116 so that the normal delayed time-base triggering inputs are isolated.
At the same time, a −24 V potential opens switching diode GR2113 in order to couple line sync. pulses to the base of TS708 of the delayed time-base.
LEVEL pot. meter R9 is now out of service, because a d.c. level is generated with the aid of C2132, GR2116, R2173 and R2178.
Because switches SK5 and SK19 are now used to provide sync. separator output selection, the triggering LEVEL x5 facility is not incorporated in the PM 3250X oscilloscope.



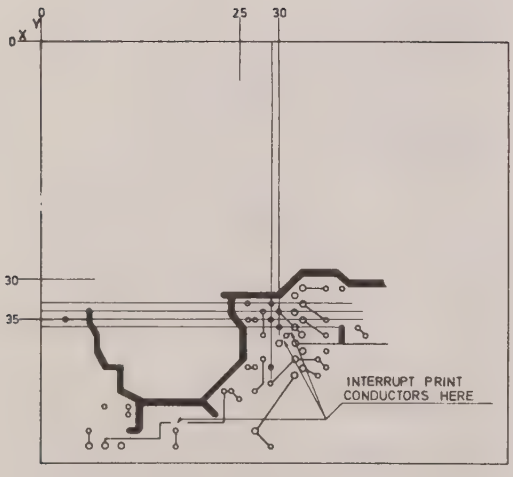


R 941 AND R939 DISPLACED (MOUNTED ON COMPONENTS'-SIDE OF PRINT)
R943 AND R2102 MOUNTED
TS2101 MOUNTED ON COMPONENTS-SIDE OF PRINT

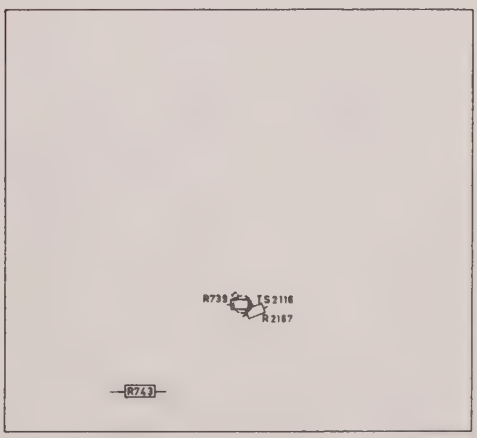
MODIFICATION
PRINTED CIRCUIT MAIN TIME BASE UNIT U12X
(REAR SIDE)

PM3250X

FIG.3



• 2x HOLE DIA 1.3MM

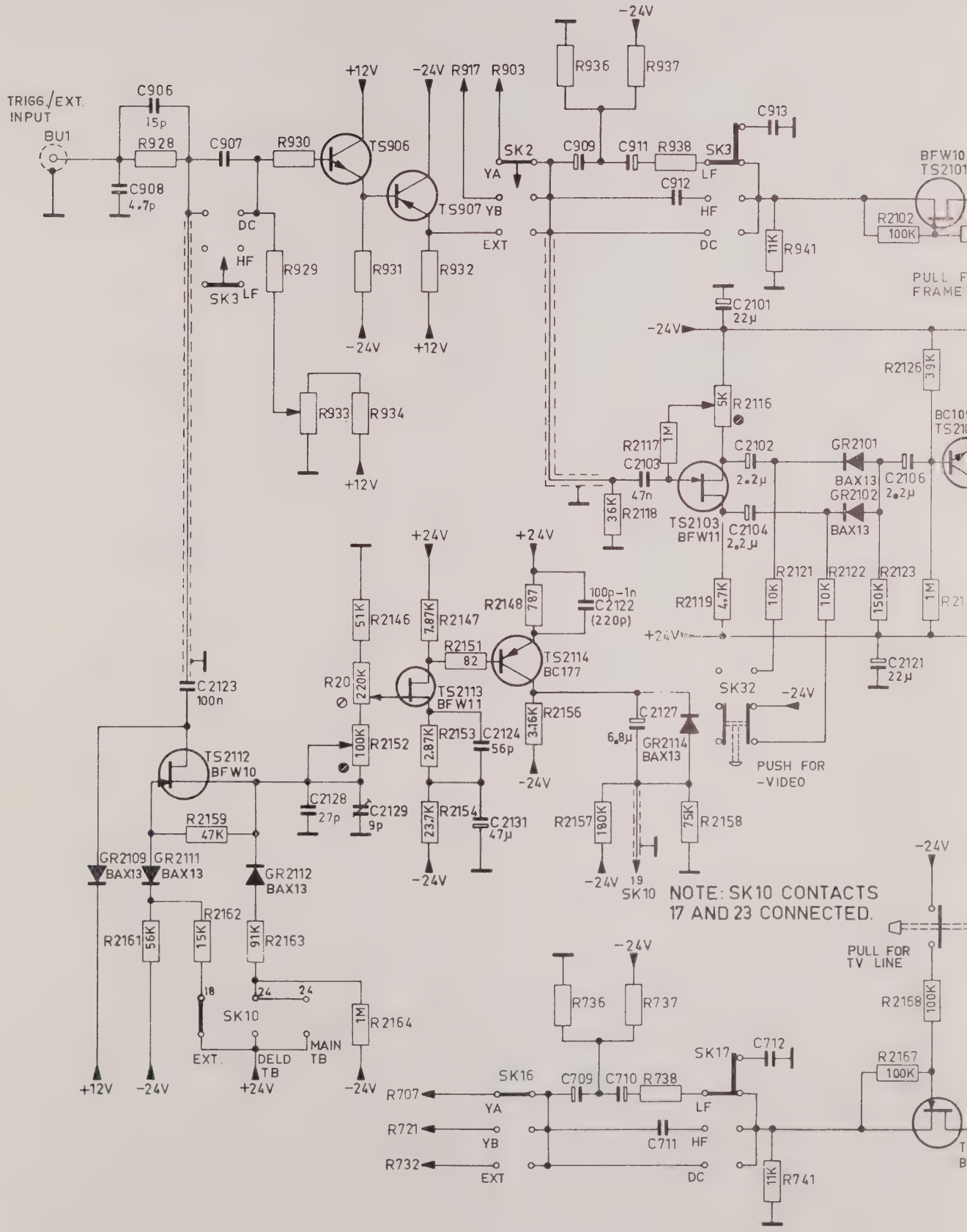


R739 DISPLACED
R743 AND R2167 MOUNTED
TS2116 MOUNTED ON COMPONENTS-SIDE OF PRINT

MODIFICATION
PRINTED CIRCUIT DELAY TIME BASE UNIT U11X
(REAR SIDE)

PM3250X

FIG. 4


TRIGG./EXT. INPUT
BU1
C906 15p
C908 4.7p
R928
C907
R930
TS906
TS907
+12V
-24V
R917
R903
R936
R937
C913
SK2
YA
C909
C911
R938
SK3
LF
C912
HF
DC
EXT
YB
R941
11K
R2102 100K
BFW10 TS2101
PULL F FRAME
R929
R931
R932
R933
R934
C2101 22µ
R2126 39K
5K R2116
1M
R2117
C2103 47n
C2102 2.2µ
GR2101
BAX13 GR2102
C2106 2.2µ
36K R2118
TS2103 BFW11
C2104 2.2µ
BAX13
R2119 4.7K
R2121 10K
R2122 10K
R2123 150K
1M
C2121 22µ
+24V
R2146 51K
R2147 7.87K
R2148 787
C2122 (220p)
100p-1n
R2151 82
TS2114 BC177
R20 220K
TS2113 BFW11
C2123 100n
R2152 100K
R2153 2.87K
C2124 56p
R2156 3.16K
C2127 6.8µ
GR2114 BAX13
SK32
PUSH FOR -VIDEO
TS2112 BFW10
C2128 27p
C2129 9p
R2154 23.7K
C2131 47µ
R2157 180K
R2158 75K
R2159 47K
GR2109 BAX13
GR2111 BAX13
GR2112 BAX13
R2161 56K
R2162 15K
R2163 91K
SK10
EXT.
DELD TB
MAIN TB
R2164 1M
NOTE: SK10 CONTACTS 17 AND 23 CONNECTED.
PULL FOR TV LINE
R2168 100K
R2167 100K
R736
R737
SK16
SK17
C709
C710
R738
C712
R707
R721
R732
C711
R741
11K

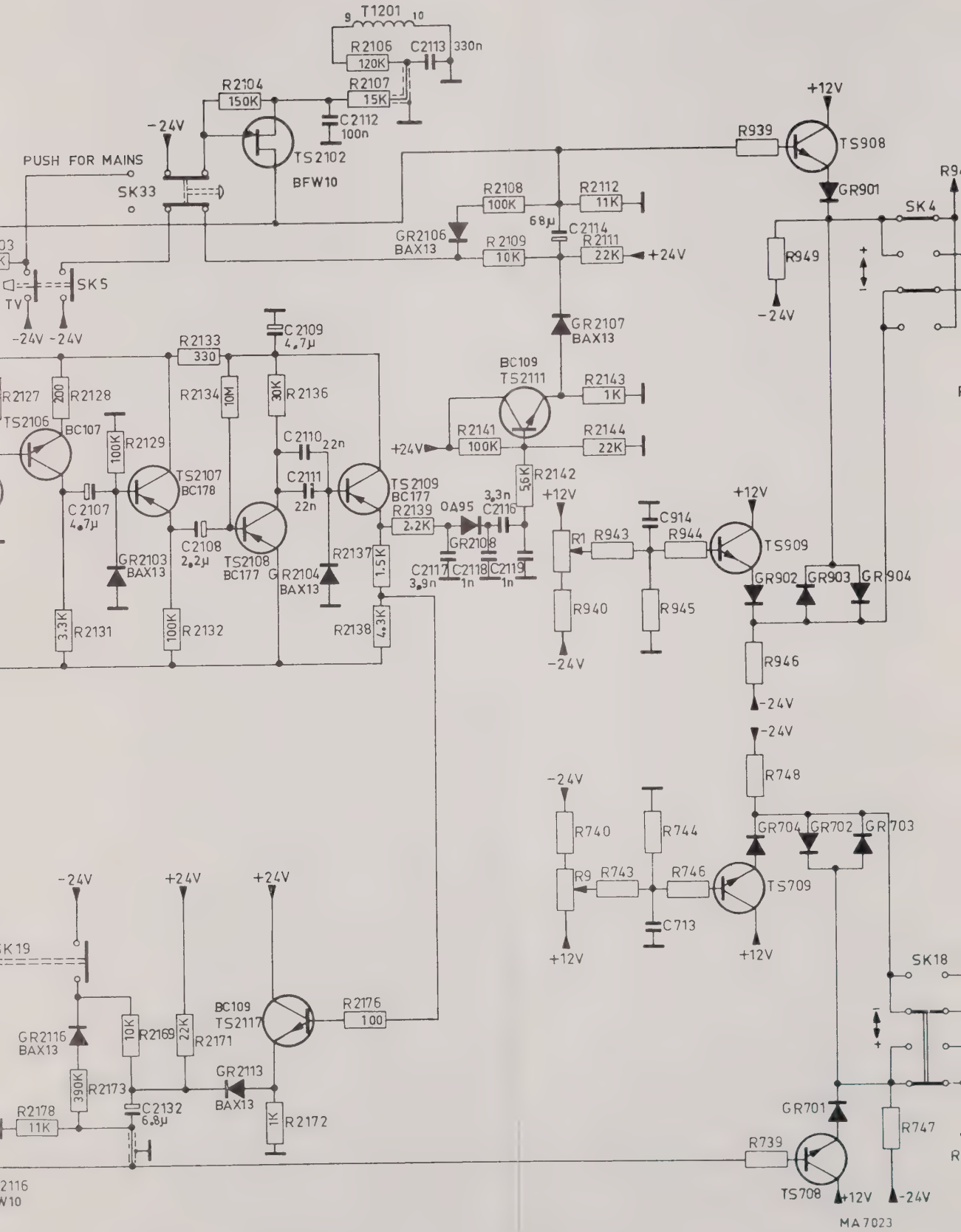

T1201
R2106 120K
C2113 330n
R2104 150K
R2107 15K
C2112 100n
TS2102 BFW10
-24V
PUSH FOR MAINS
SK33
SK5
TV
R2108 100K
R2112 11K
68µ C2114
GR2106 BAX13
R2109 10K
R2111 22K
+24V
GR2107 BAX13
+12V
R939
TS908
GR901
SK4
R949
-24V
C2109 4.7µ
R2133 330
R2127 200
R2128
R2134 10M
30K R2136
TS2106 BC107
100K R2129
C2110 22n
C2111 22n
TS2107 BC178
TS2109 BC177
C2107 4.7µ
C2108 2.2µ
TS2108 BC177
GR2103 BAX13
GR2104 BAX13
R2137 1.5K
R2139 2.2K
OA95
3.3n C2116
GR2108
C2117 3.9n
C2118 1n
C2119 1n
3.3K R2131
100K R2132
R2138 4.3K
BC109 TS2111
R2143 1K
R2141 100K
R2144 22K
5.6K R2142
+12V
R1
R943
C914
R944
TS909
GR902 GR903 GR904
R940
R945
R946
-24V
R748
R740
R744
R9
R743
R746
TS709
C713
GR704 GR702 GR703
SK18
SK19
GR2116 BAX13
10K R2169
22K R2171
BC109 TS2117
R2176 100
GR2113 BAX13
390K R2173
R2178 11K
C2132 6.8µ
1K R2172
GR701
R747
R739
TS708
MA7023

FIG. 5

C. MAINS TRIGGERING FACILITY

The main time-base of the oscilloscope may be triggered by means of a mains frequency signal derived from winding S2 of supply transformer TS2101.
The mains frequency signal source is passed through a filtering and attenuation network before being fed to field effect transistor TS2102 which performs a gating function under the control of the PUSH FOR MAINS switch (SK33).

Operation of the PUSH FOR MAINS switch (SK33) causes the mains frequency triggering signal to be coupled to the base of transistor TS908 (main time-base) due to the gating action of field effect transistor TS2102. At the same time, contacts of the PUSH FOR MAINS switch SK33 also completes a pinch-off supply to a second field effect transistor (TS2101) in order to isolate the normal triggering circuits which are connected to the main time-base via the Y_A/Y_B/EXTERN and HF/LF/DC switches SK2 and SK3.
In addition to this, the PUSH FOR MAINS switch contacts also interrupt the −24 V control potential for the frame sync. output switching diodes so that it is not possible to couple sync. separator outputs whilst the oscilloscope is operating in the mains triggering mode.

D. EXTERNAL HORIZONTAL INPUT CIRCUIT

The external horizontal input circuit consists of a field effect transistor gating stage controlled by means of the X DEFL. switch SK10, and a preamplifier stage. An external horizontal input signal, connected to the oscilloscope by way of the main time-base TRIGG./EXT. X socket BU1, may be used to drive the horizontal output amplifier provided that the X DEFL. switch SK10 is set to its EXTERN position. This facility, which replaces the EXTERN VIA YB function of the basic PM 3250 design, may be used in conjunction with a sweep generator in order to obtain a simultaneous display of two vertical signals.

The two-stage preamplifier circuit, formed by transistors TS2113 and TS2114, provides a x8 gain in order to compensate for signal attenuation in the input stage.

Preset potentiometer R20 which forms part of the horizontal preamplifier circuit, enables the gain to be set within the limits of 1.0 V/div. to 5.0 V/div. (0.1 V/div. to 0.5 V/div. if the MAGN. switch is set to its x10 position).
Trimmer R2152 enables the gain of the amplifier to be calibrated, with R20 set to its fully clockwise position. The output of the preamplifier is connected to the main horizontal amplifier by way of switch SK10 contacts.

Input signals connected to the main time-base TRIGG./EXT. socket BU1 are passed to the preamplifier by means of the gating stage which is formed by field effect transistor TS2112, diodes GR2111 and GR2112, and resistors R2161, R2162, R2163 and R2164. TS2112 is protected against overvoltage with the aid of GR2109.
The gating stage is controlled by means of the X DEFL. switch SK10.

Setting the X DEFL. switch SK10 to its EXTERN position causes a positive potential to be removed from the anode of GR2112 and to be applied to the cathode of GR2111. This change in bias results in field effect transistor TS2112 being opened so that the signal present at the TRIGG./EXT. X socket is coupled to the preamplifier. At the same time, the preamplifier is connected to the main horizontal amplifier via contacts of the X DEFL. switch SK10.

E. CIRCUIT MODIFICATIONS

The following modifications have been made to the basic PM 3250 circuit assemblies in order to make them suitable for the X version:

Added: – a printed circuit board containing the various circuits related to the PM 3250X version.
– a pot. meter (R20) mounted at the right-hand side of the cabinet, used as attenuator for the external horizontal amplifier.

Modified:

1. Supply unit U1

The following components have been connected across winding S2 of transformer T1201 in order to pick off the mains frequency signal for the mains triggering facility:

a. capacitor C2113, 0.33 μF ±10 %, 400 V
b. resistor R2106, 120 kΩ, 5 %, CR25
c. 50 Ω cable to unit U10

2. Time-base U10

The values of capacitors C906 and C908 in the TRIGG./EXT. X input circuit are changed as follows:

a. C906 becomes 15 pF
b. C908 becomes 5.6 pF
c. Resistors R742 and R942 (used in the basic PM 3250 to provide the triggering level x5 magnification facility) have been removed.

3. Delayed time-base U11 (part of unit U10)

This unit is termed U11X after incorporation of the following modifications:

a. An additional resistor R2167 and field effect transistor TS2116 (part of the delayed time-base trigger gating circuit) have been added.
b. Resistor R741 becomes 11 kΩ, 5 %
c. The printed wiring has been modified as detailed in Fig. 4.

4. Main time-base U12 (part of unit U10)

This unit is termed U12X after incorporation of the following modifications:

a. Resistor R941 becomes 11 kΩ, 5 %
b. Resistor R1124 becomes 750 Ω, 1 % (x10 MAGN. modification)
c. An additional resistor R2102 and field effect transistor TS2101 (part of the main time-base trigger gating circuit) has been added.
d. The printed wiring has been modified as detailed in Fig. 3.

5. Intermediate amplifier U26

This circuit board assembly has been modified as follows:

– Transistors TS514, TS1151 and TS1152 have been removed.

VI. Calibration

A. INTRODUCTION

The PM 3250X may be calibrated in the same way as stated in the checking and adjusting section of the basic PM 3250 manual, provided that the PULL FOR TV FRAME and PULL FOR TV LINE switches are both depressed (i.e. sync. separator outputs not coupled). Additional calibration procedures required for the PM 3250X are detailed in the following paragraphs.

B. SYNC. SEPARATOR

– R2116, which serves for adjusting the symmetry of the source and drain signals of TS2103, must be in its mid position.

C. EXTERNAL HORIZONTAL INPUT

– Set the X DEFL. switch (SK10) to its EXTERN position.
– Set the horizontal attenuator at the right-hand side in the calibrated position (fully clockwise).
– Apply a 2 kHz sine wave signal with an amplitude of 6 V to the TRIGG./EXT. X socket (BU1).
– Adjust trimmer R2152 in order to obtain a deflection of 6 div's (deflection factor 1 V/div.).
– Now apply a 10 kHz square-wave signal with an amplitude of 6 V to the TRIGG./EXT. X socket.
– Connect a saw tooth signal, which is triggered by the 10 kHz square wave, to the YA socket.
– Adjust trimmer C2129 for optimum square-wave response.

VII. List of added or modified components

Item	*Code number*	*Description*
On front panel		
SK32, 33	5322 276 54011	Push button switch assembly
Printed circuit boards		
–	5322 216 54062	Added unit (Fig. 2)

For modified units, the standard printed circuit board must be ordered under the code numbers indicated in the basic PM 3250 manual.
These p.c.b.'s must then be altered as indicated in chapter V.E. of this Appendix.

Various components		
R20	5322 101 20079	Pot. meter 220 k lin. Ø 16 mm
–	5322 455 84004	Front panel text plate

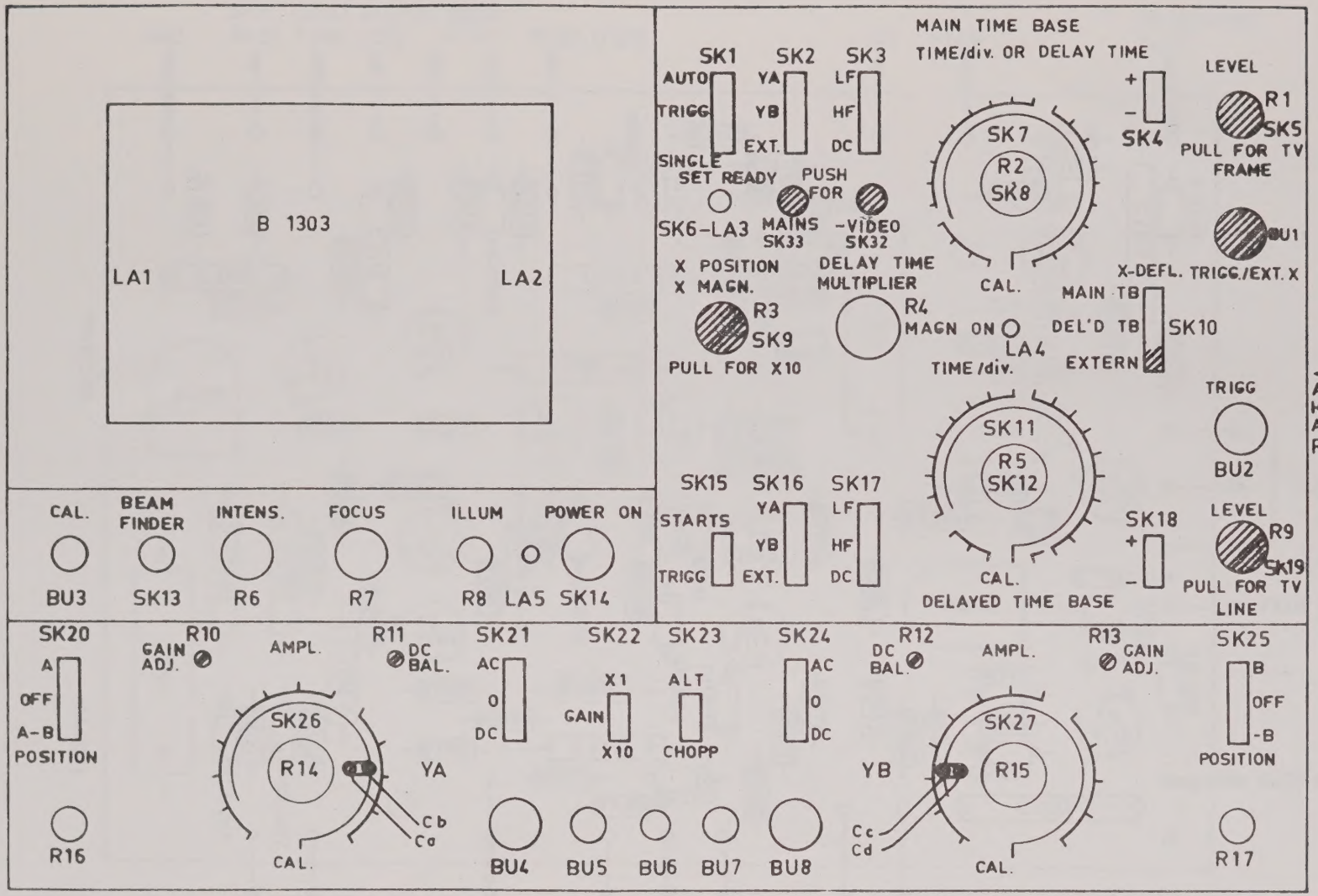


FIG.1

MA7031

FRONT PANEL
PM3250X

SK10/U12X P.19
GR2114
R2146
C2127
R2151
R20
+12V
SK3/C907
GR2109
C2128
C2129
TS 2113
TS 2112
C2123
R2158
R2157
R2156
TS 2114
R2148
C2122
R2147
C2131
R2153
C2124
R2154
R2152
GR2112
R2159
GR2111
R2163
R2164
-24V +24V
C2121
R2161
R2162
P.18 P.24
SK10/U12X
C2119
C2116
C2118
C2117
R2176
R2172
R2142
R2144
R2138
R2139
R2137
GR2108
R2141
TS 2109
TS 2117
R2171
R2169
R2143
GR2113
C2111
C2110
R2136
GR2104
TS 2111
TS 2108
GR2107
R2112
C2114
R2111
C2108
R2134
C2116
R2166
SK19
bTS2116 U11X
R939 U12X
GR2103
R2129
C2107
R2131
C2109
C2132
R2173
R2133
R2109
GR2106
R2108
TS 2107
TS 2102
R2132
TS 2104
TS 2106
R2128
R2178
R739 U11X
SK33 bTS2101 U12X
R2104
C2112
R2107
R2127
R2123
C2106
SK5 C2113 SK33 R2106 U12X
TS 2103
R2119
R2126
R2124
R2122
GR2102
C2104
R2121
SK32
R2103
C2103
R2117
GR2101
C2102
R2116
R2118
C2101
SK2
PM3250X
MA7024

FIG.2